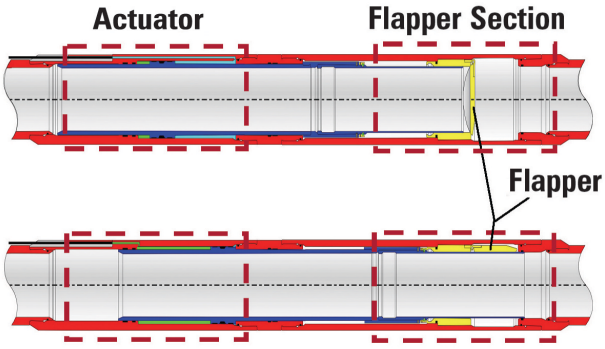
UBO evolves with new technology, applications

MUD CAP DRILLING

WELL CONTROL IN carbonate gas reservoirs is a challenge when the primary well control is compromised due to total losses. In the carbonate reservoirs offshore Borneo, total losses occur every 6th well. The common method to regain well control and continue drilling is by placing a cement or gunk plug over the loss zone.

In 2003, an exploration well was drilled into the M3 South Carbonate with a semisubmersible drilling rig. Total losses were encountered before reaching the required drilling depth.

Due to the high mud consumption and high risk of continuing drilling, the well had to be plugged back and abandoned. The decision was made to drill an additional appraisal well utilizing pressured mud cap drilling (PMCD).



A solution to some of the financial and technical challenges of underbalanced operates has been found in a newly developed technology called the downhole isolation valve (DIV). SPE/IADC 92595.

The main challenges to achieve the objectives successfully were rigging up a rotating control device (RCD) on a semisubmersible; developing PMCD procedures for drilling an overpressured, highly prolific gas reservoir; and data acquisition, i.e. coring, logging while drilling (LWD) and wireline logging under PMCD conditions.

To manage surface pressures, a design was made to rig up an RCD on to the drilling riser. Detailed procedures were developed to drill with the system. The design and procedures were HAZOP-ed and tested on two preceding wells. In May 2004, the higher risk M3 South Appraisal well was drilled encountering total losses in the carbonate gas reservoir.

The PMCD system was activated and the section was successfully drilled to TD with a full suite of LWD tools. The further operations were challenging, as gas percolation rates were higher than expected.

Some operations had to be compromised but the PMCD operations were finished successfully, giving encouraging results and learnings for the future. These learnings will now be taken forward to extend the operation envelope under PMCD conditions.

Pressured Mud Cap Drilling from a Semisubmersible Drilling Unit (SPE/IADC 92294) **J Terwogt**, **Shell Malaysia**; **G H Medly**, **Signa Engineering**.

DOWNHOLE ISOLATION VALVE

The industry has fully embraced and adopted the true benefits of underbalanced operations in the Southern North Sea. Since 1996, the critical steps have been undertaken to advance from a low-head drilling operation, where the well was killed during trips, to the current fully underbalanced operation, which encompasses drilling through to the completion of the well.

One of the key contributors to the success has been the snubbing unit that allows underbalanced tripping. Now, two additional challenges have been raised, reduction of operation cost and installation of sand control systems while maintaining an underbalanced state.

A solution to some of the financial and technical challenges has been found in a newly developed technology called the downhole isolation valve (DIV).

DIV technology is based on a casing-deployed downhole valve system that is used to shut in the well at a predetermined depth and allows for lubrication of the drillstring or completion assembly into the well.

The authors will present a case history and cover the steps that were taken to prepare for introduction of the DIV.

The authors will reveal how the technology has ultimately proved to be a viable alternative to snubbing operations to cut tripping times in half.

Plans will be presented to introduce expandable sand screens into an underbalanced operation to overcome the hurdles of implementing a sand control program.

The significance of the subject is the technology's capability to reduce the overall cost and complexity of the underbalanced operation by enabling the integration of two wellbore performance-enhancing technologies.

New Downhole Isolation Valve Technology Reduces Costs and Increases Capabilities of Underbalanced Drilling and Completion Programs in the Southern North Sea (SPE/IADC 92595) **I C Sutherland**, **Weatherford Drilling & Well Services**; **B Grayson**, **Weatherford International**.

MANAGED PRESSURE DRILLING

Managed Pressure Drilling (MPD) was first coined in a paper given at the 2003 SPE/IADC in Amsterdam (SPE/IADC #79854). The paper described a number of non-underbalanced applications of underbalanced drilling (UBD) tools and technology when drilling in marine environments.

The focus was not on inviting influx while drilling ahead, as in UBD, but on a litany of benefits associated with drilling in marine environments with a closed and pressurizable mud returns system.

Where UBD focuses upon increasing production potential via less skin damage, MPD focuses upon dealing with a litany of drilling-related problems encountered when drilling overbalanced, issues that contribute to greater than 60% of all offshore prospects being considered economically undrillable.

MPD enables more precise wellbore pressure management, resulting in enhanced well control, less flat time, deeper and fewer casing set points, and a deeper open hole.

The author will present the variations of MPD as defined by the IADC MPD Subcommittee, which variation applies to overcome

which drilling-related obstacles, and from what type of rig each variation is applicable. Case studies will be presented on zero discharge riserless drilling, contingency MPD in shallow water and proactive MPD in deepwater.

Managed Pressure Drilling in Marine Environments (SPE/IADC 92600) **Don Hannegan**, **Weatherford**.

ELECTROMAGNETIC AND LWD

The author will discuss the planning, execution, and lessons learned from the successful application of electromagnetic (EM) and LWD technology in the horizontal Leg #1 of AMIN 116/L2-B well, drilled in the Nimr Field of Oman.

The highest daily footage drilled underbalanced in the field was achieved in this well and real-time LWD information enabled the well to be geosteered.

Also, EM transmission produced significant rig time savings compared to mud-pulse LWD systems previously used in this field largely due to faster directional surveys, resulting in better hole cleaning.

For the long term, the most significant accomplishment is the demonstration that standard EM transmission is capable of drilling these wells with real-time LWD measurement.

This is important because it enables UBD using drillpipe injection with high gas rate, which extends the envelope for UBD operations to include severely depleted reservoirs.

Petroleum Development Oman's (PDO) standard UBD practice in depleted reservoirs is to avoid severe formation damage and to use real-time LWD for geosteering horizontal multilateral wells in the most productive sections of the reservoir.

Prior to this well, application of UBD was generally accomplished using concentric casing gas injection as it was believed that the only viable means of obtaining LWD information was mudpulse transmission.

The application of EM, LWD and UBD described in this presentation is an important advance in a stepwise progression for improving PDO's ability to exploit mature reservoirs, especially those that are severely depleted.

Successful Integration of EM and LWD Technology Extends UBD Operation Envelope into Severely Depleted Fields (SPE/IADC 92617-Alternate) **M S Culen**, **Precision Drilling**.

BROWNFIELDS

As operators look at their aging reservoirs or greenfields, they face obstacles in extracting attractive economics. Underbalanced drilling applied in either roles of performance or reservoir is being adapted to address the challenges in deepwater and lower drilling costs.

Brownfields are enjoying a resurgence as smaller operators replace the majors in managing these declining reservoirs. With the majority of the world's hydrocarbons coming from fields 30 years and older, the industry is looking for methods to increase ultimate recoveries while enjoying attractive ROIs.

Why are these maturing fields only recovering 30% of their hydrocarbons in place? One of the main reasons is formation damage, particularly in depleted reservoirs. Stimulation techniques are not always the answer.

UBD technology can eliminate most forms of drilling-induced damage to leave the reservoir in as virgin state as possible. In these cases, UBD delivers superior value both in NPV and ultimate recovery.

UBD's classic role is also enjoying a renewal as its performance features are called upon to decrease the cost of accessing the reservoir. Increased ROP, extending casing points, preventing lost circulation or handling large water flows are challenges UBD is well acquainted with.

As major operators develop deepwater reservoirs, drilling costs have replaced facilities and transportation as the single largest expenditure.

Under the moniker managed pressure drilling, MPD borrows heavily from UB technology to bring its performance benefits offshore and reduce costs or make the well drillable.

Finally, UB technology looks beyond its current customer needs and anticipates them. Operators have issues besides seeking attractive economics. As societies demand cleaner fuels and environmentally friendly drilling, UBD must adapt to these pressures.

With the Asset Capture System (ACS)the world's first closed-loop re-circulation system, emissions are contained, energy is conserved and UBD operations are simplified.

Proving UBDB's Value in Brownfields and Beyond (SPE/IADC 91725-Alternate) **C S Holt**, **Weatherford International**.